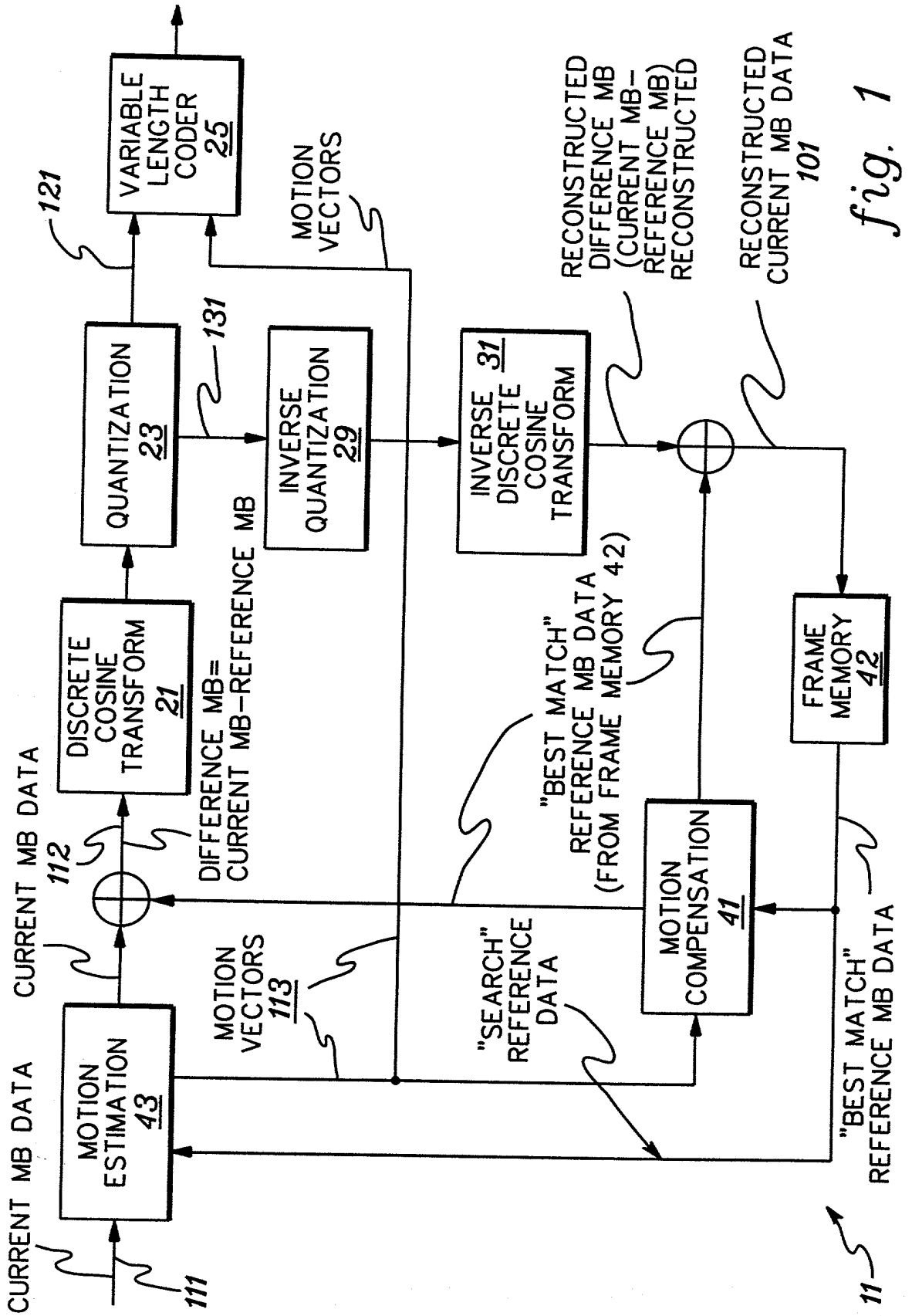

VARIABLE LENGTH CODER 25
121
MOTION VECTORS
RECONSTRUCTED DIFFERENCE MB (CURRENT MB-REFERENCE MB) RECONSTRUCTED
RECONSTRUCTED CURRENT MB DATA 101
QUANTIZATION 23
131
INVERSE QUANTIZATION 29
INVERSE 31 DISCRETE COSINE TRANSFORM
DISCRETE COSINE TRANSFORM 21
DIFFERENCE MB= CURRENT MB-REFERENCE MB
"BEST MATCH" REFERENCE MB DATA (FROM FRAME MEMORY 42)
FRAME MEMORY 42
CURRENT MB DATA
112
MOTION VECTORS 113
"SEARCH" REFERENCE DATA
MOTION COMPENSATION 41
MOTION ESTIMATION 43
CURRENT MB DATA
111
"BEST MATCH" REFERENCE MB DATA
11

fig. 1

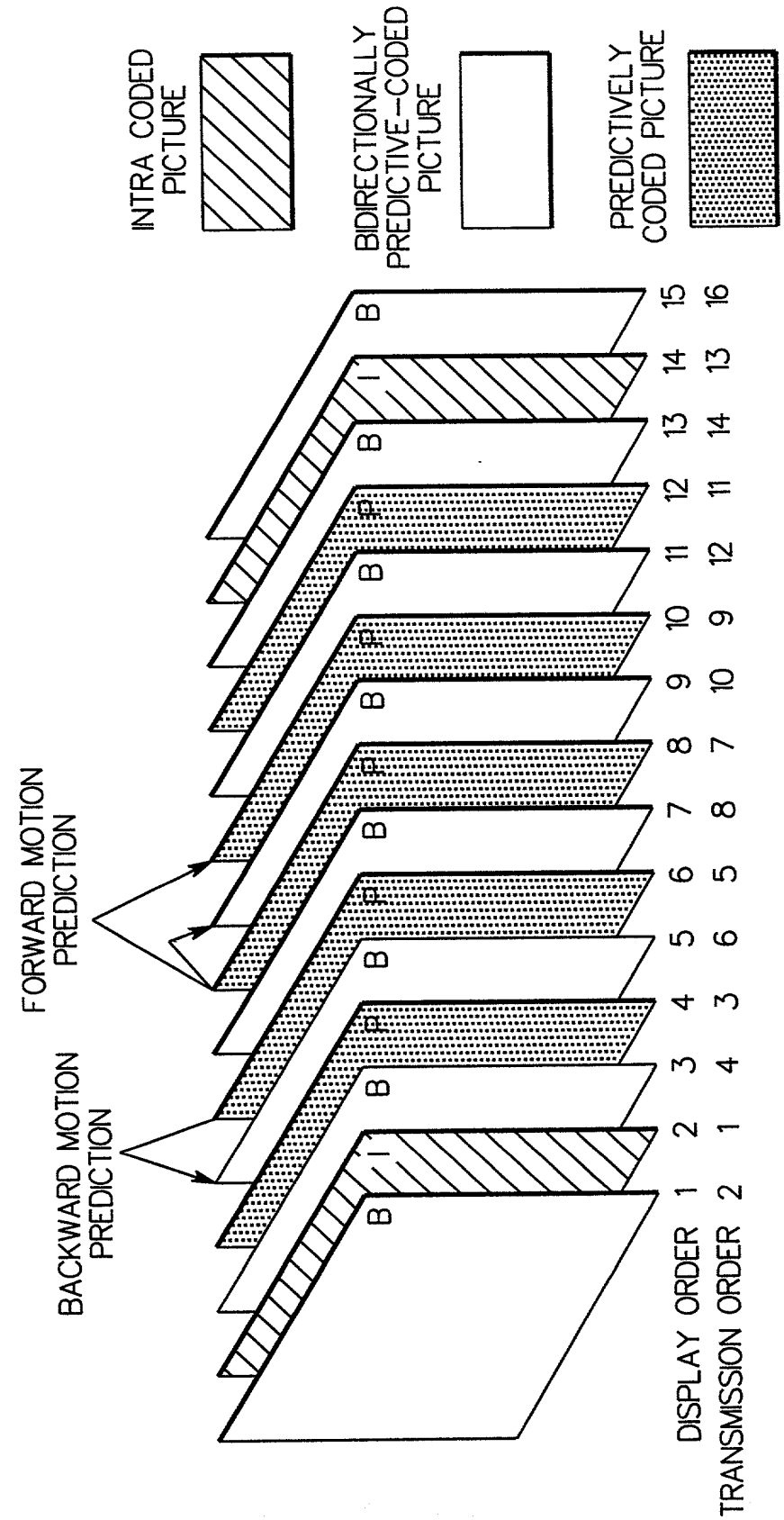

INTRA CODED PICTURE
BIDIRECTIONALLY PREDICTIVE-CODED PICTURE
PREDICTIVELY CODED PICTURE
FORWARD MOTION PREDICTION
BACKWARD MOTION PREDICTION
DISPLAY ORDER 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
TRANSMISSION ORDER 2 1 4 3 6 5 8 7 10 9 12 11 14 13 16 15
I
B
P

fig. 2

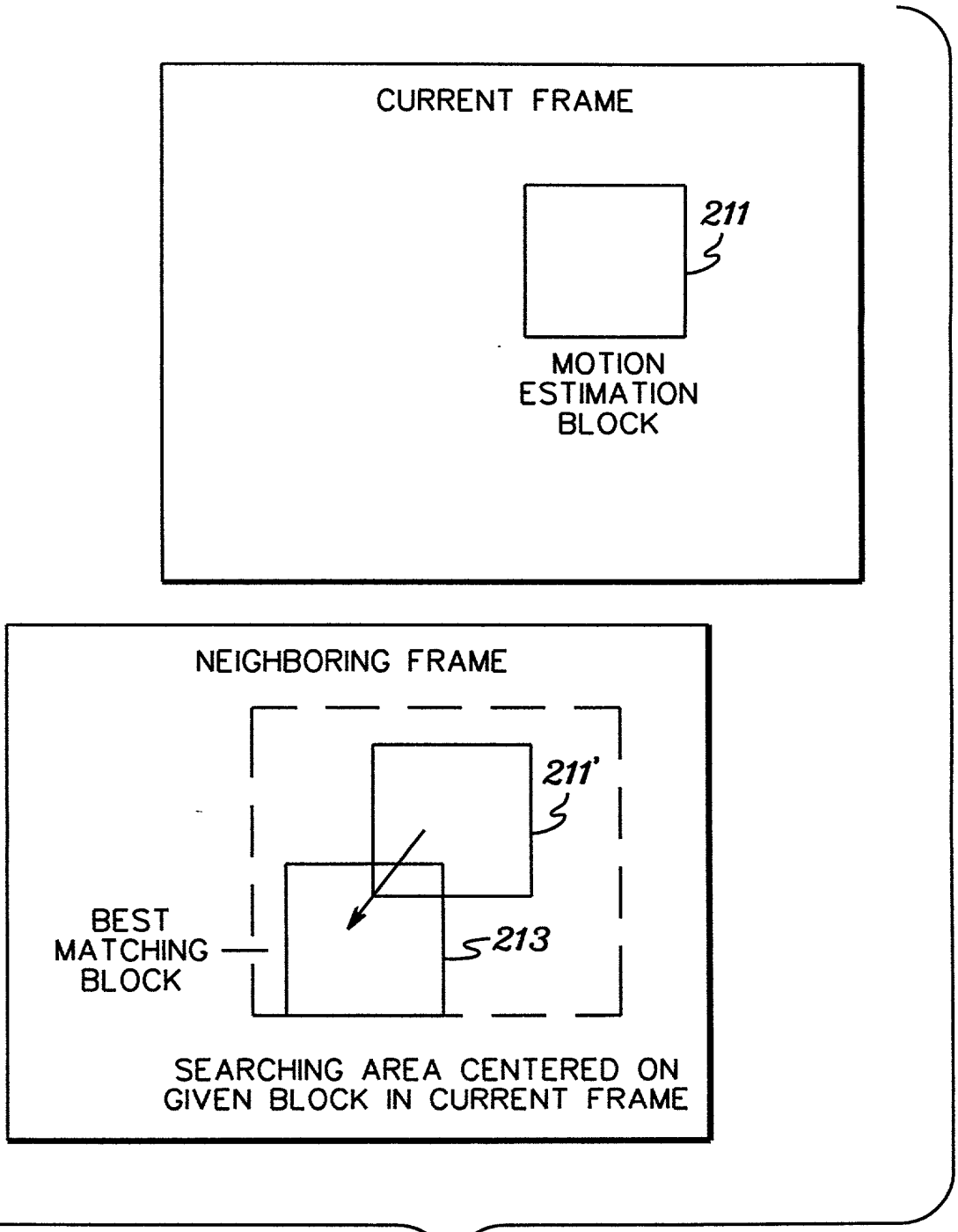
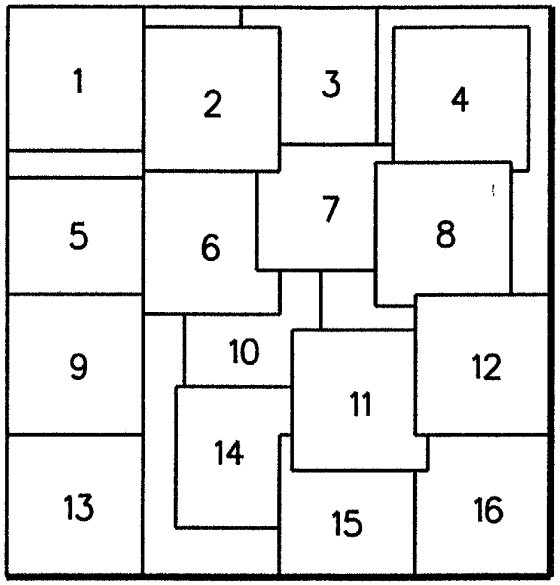
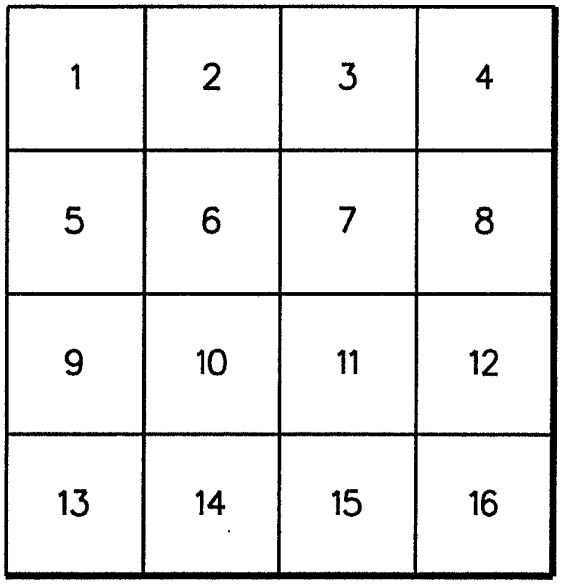

CURRENT FRAME
211
MOTION ESTIMATION BLOCK
NEIGHBORING FRAME
211'
213
BEST MATCHING BLOCK
SEARCHING AREA CENTERED ON GIVEN BLOCK IN CURRENT FRAME

fig. 3



BLOCKS OF PREVIOUS PICTURE
USED TO PREDICT CURRENT PICTURE



CURRENT PICTURE AFTER USING
MOTION VECTORS TO ADJUST
PREVIOUS PICTURE BLOCK POSITIONS

fig. 4

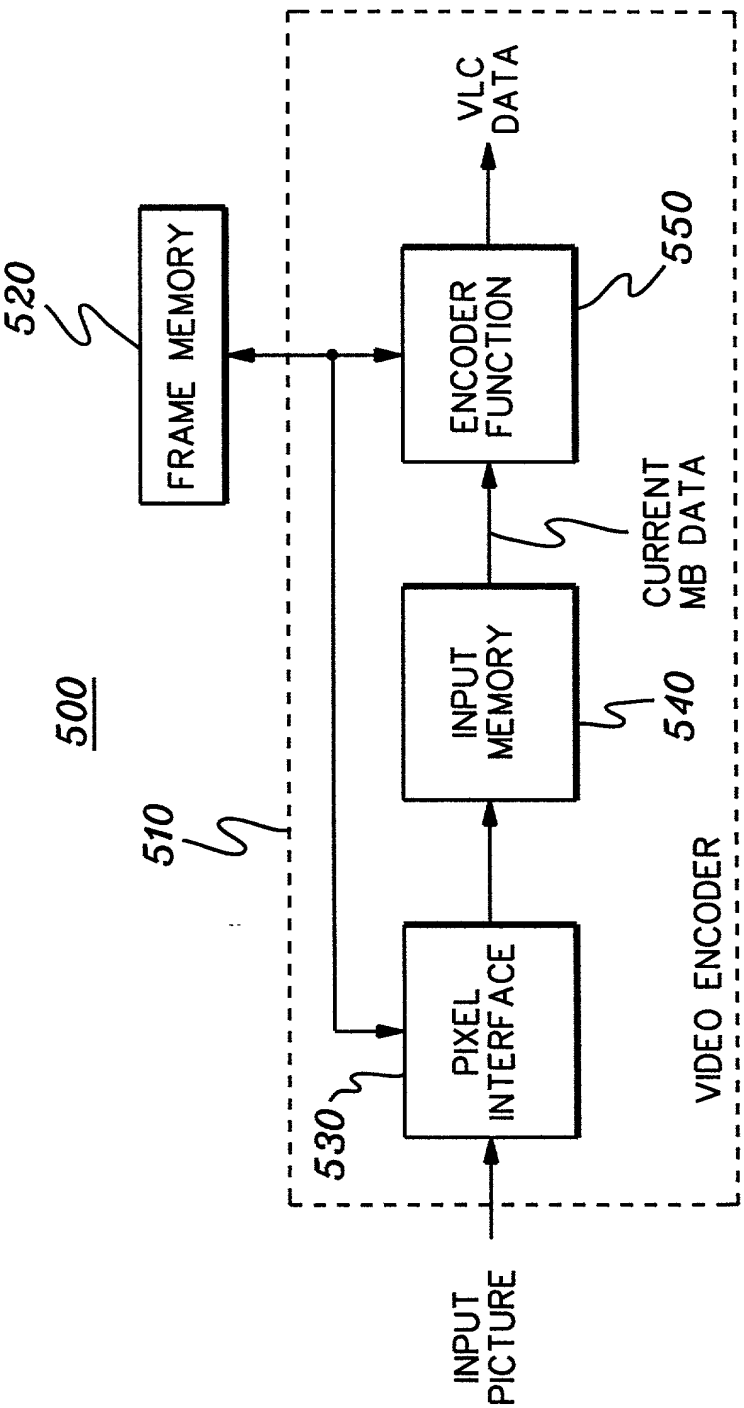

500
510
VIDEO ENCODER
520
FRAME MEMORY
530
PIXEL INTERFACE
540
INPUT MEMORY
CURRENT MB DATA
550
ENCODER FUNCTION
VLC DATA
INPUT PICTURE

fig. 5

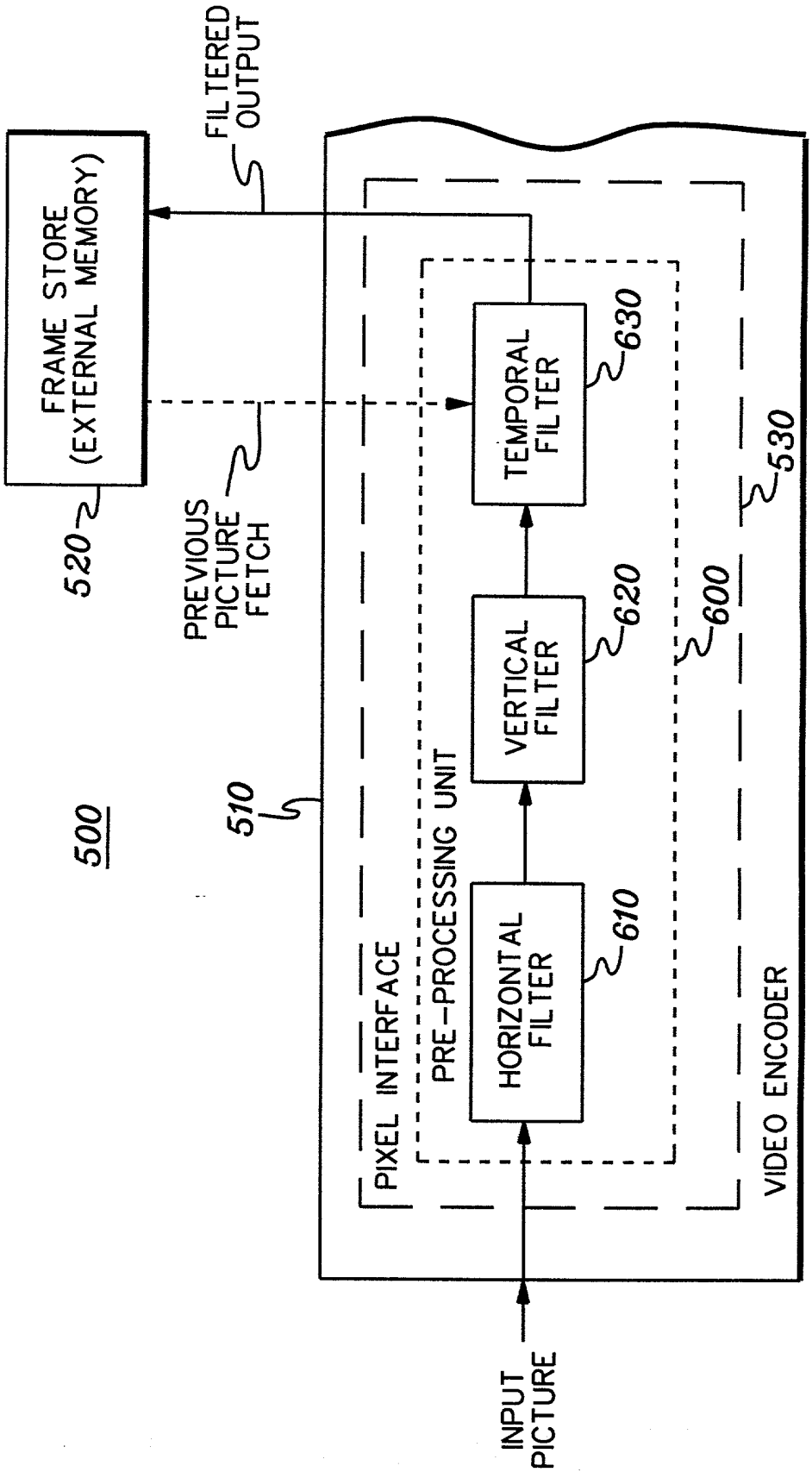

500
FRAME STORE (EXTERNAL MEMORY)
520
FILTERED OUTPUT
PREVIOUS PICTURE FETCH
510
VIDEO ENCODER
530
PIXEL INTERFACE
PRE-PROCESSING UNIT
600
HORIZONTAL FILTER
610
VERTICAL FILTER
620
TEMPORAL FILTER
630
INPUT PICTURE

fig. 6

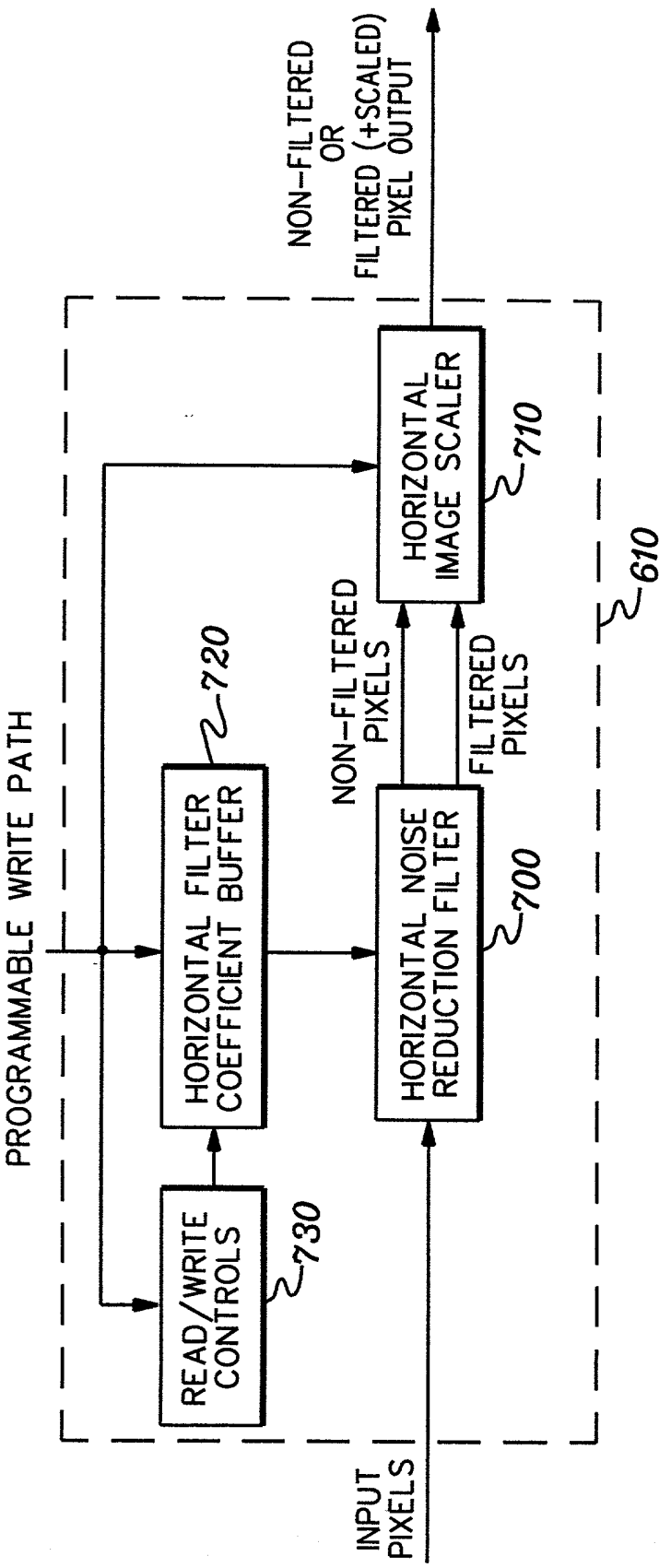

NON-FILTERED
OR
FILTERED (+SCALED)
PIXEL OUTPUT
HORIZONTAL
IMAGE SCALER
710
610
NON-FILTERED
PIXELS
FILTERED
PIXELS
HORIZONTAL NOISE
REDUCTION FILTER
700
HORIZONTAL FILTER
COEFFICIENT BUFFER
720
PROGRAMMABLE WRITE PATH
READ/WRITE
CONTROLS
730
INPUT
PIXELS

fig. 7

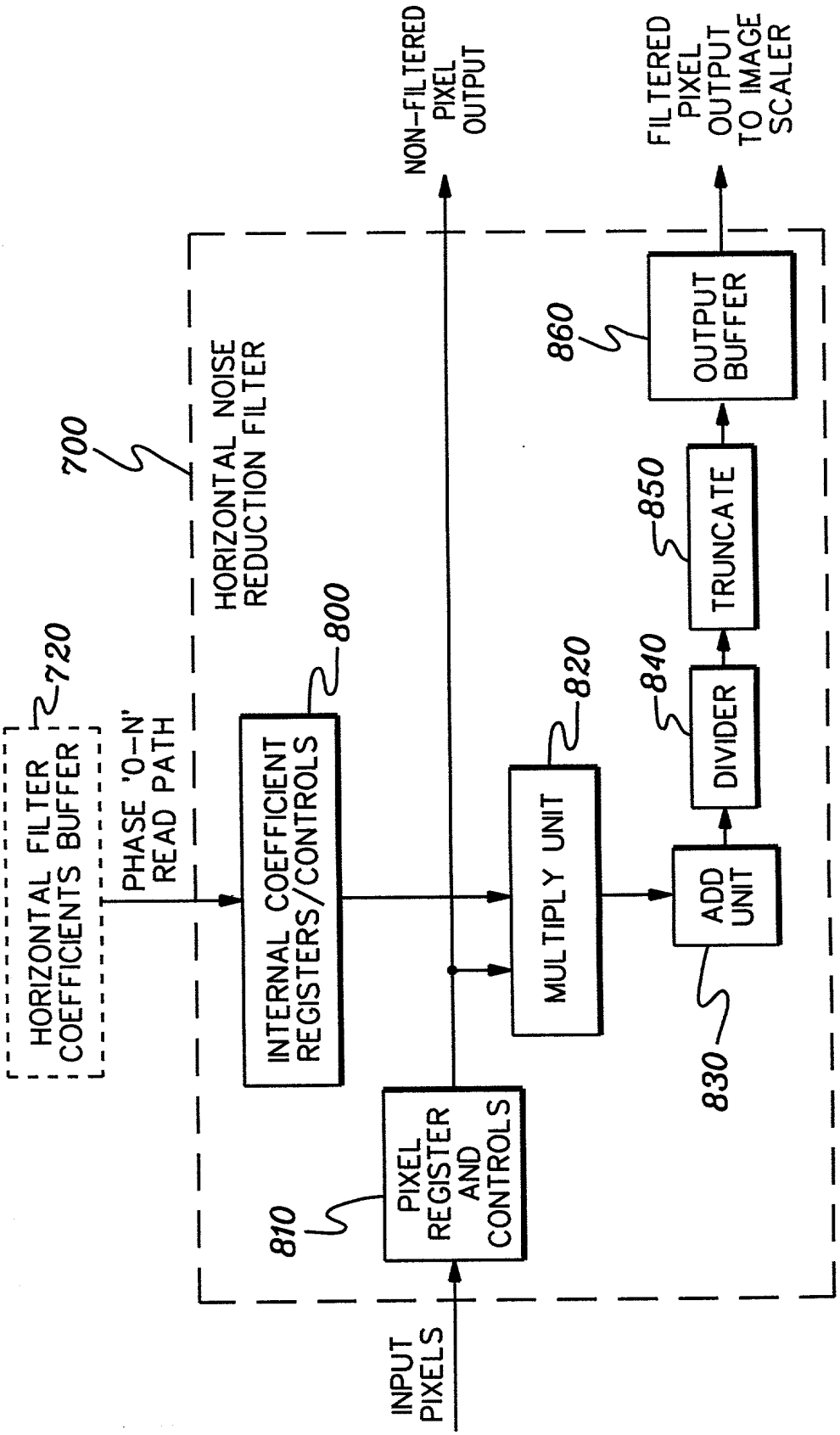

INPUT PIXELS
NON-FILTERED PIXEL OUTPUT
FILTERED PIXEL OUTPUT TO IMAGE SCALER
HORIZONTAL NOISE REDUCTION FILTER
700
HORIZONTAL FILTER COEFFICIENTS BUFFER
720
PHASE '0-N' READ PATH
INTERNAL COEFFICIENT REGISTERS/CONTROLS
800
PIXEL REGISTER AND CONTROLS
810
MULTIPLY UNIT
820
ADD UNIT
830
DIVIDER
840
TRUNCATE
850
OUTPUT BUFFER
860

fig. 8

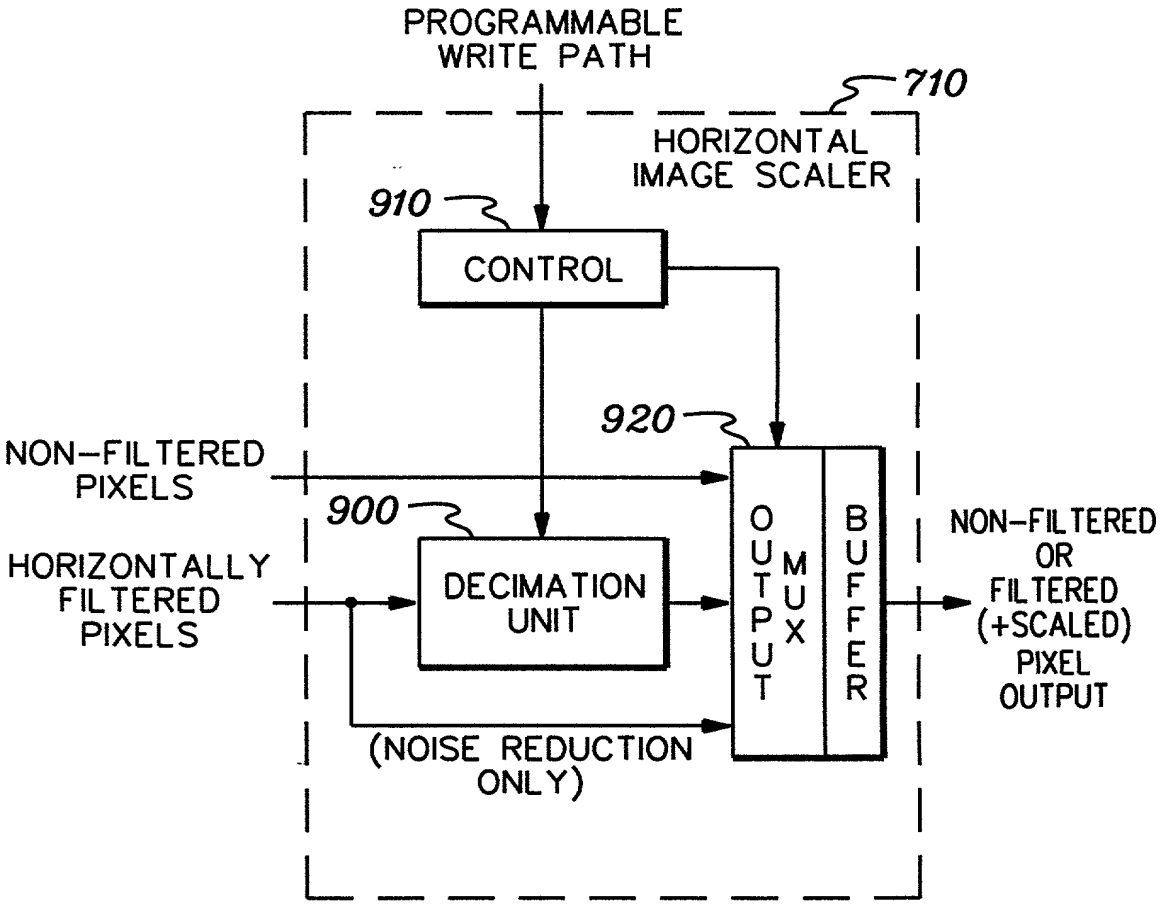

PROGRAMMABLE
WRITE PATH
710
HORIZONTAL
IMAGE SCALER
910
CONTROL
920
NON-FILTERED
PIXELS
900
HORIZONTALLY
FILTERED
PIXELS
DECIMATION
UNIT
OUTPUT MUX
BUFFER
NON-FILTERED
OR
FILTERED
(+SCALED)
PIXEL
OUTPUT
(NOISE REDUCTION
ONLY)

fig. 9

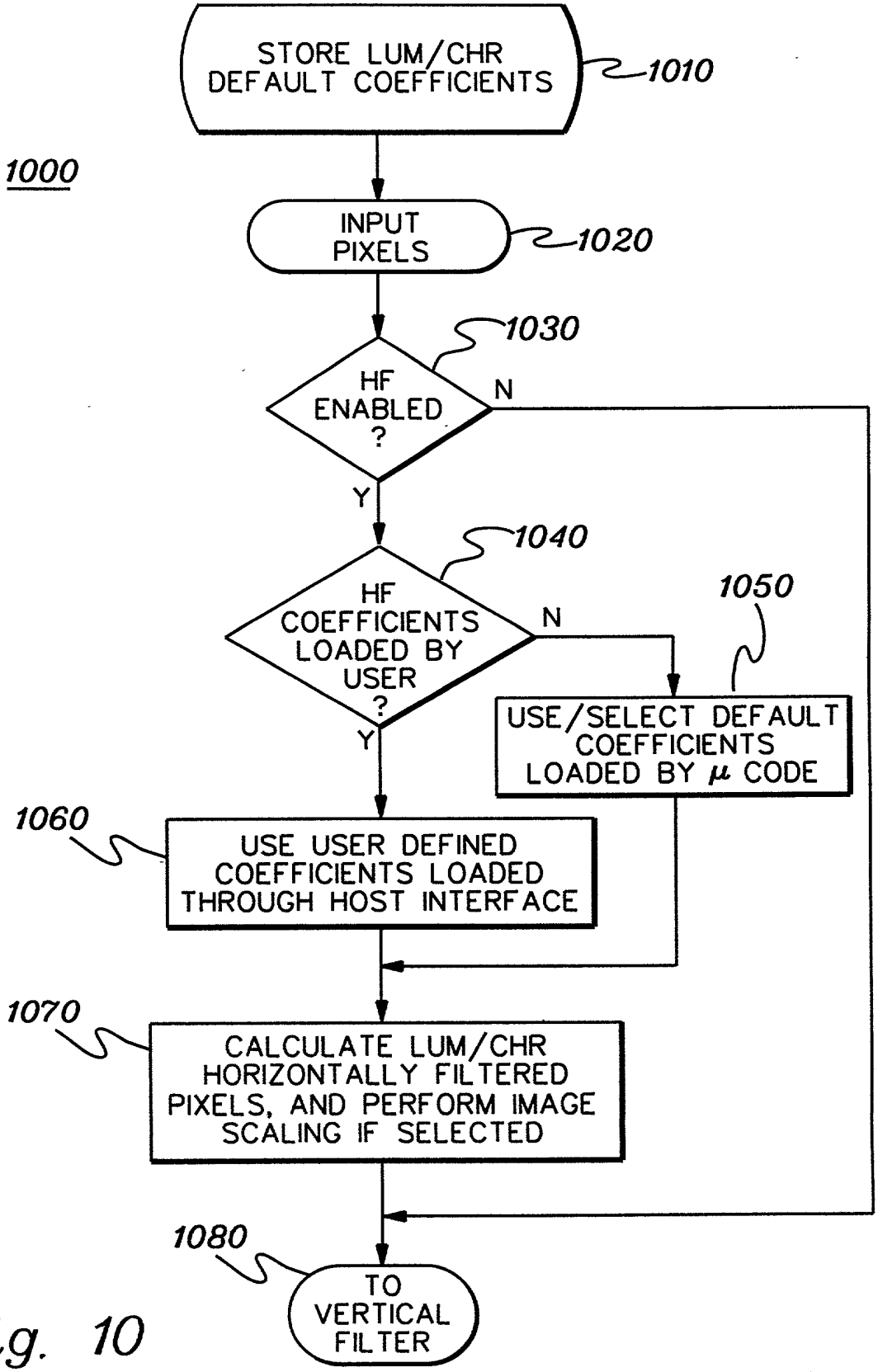

1000
STORE LUM/CHR DEFAULT COEFFICIENTS
1010
INPUT PIXELS
1020
1030
HF ENABLED ?
N
Y
1040
HF COEFFICIENTS LOADED BY USER ?
N
Y
1050
USE/SELECT DEFAULT COEFFICIENTS LOADED BY μ CODE
1060
USE USER DEFINED COEFFICIENTS LOADED THROUGH HOST INTERFACE
1070
CALCULATE LUM/CHR HORIZONTALLY FILTERED PIXELS, AND PERFORM IMAGE SCALING IF SELECTED
1080
TO VERTICAL FILTER

fig. 10

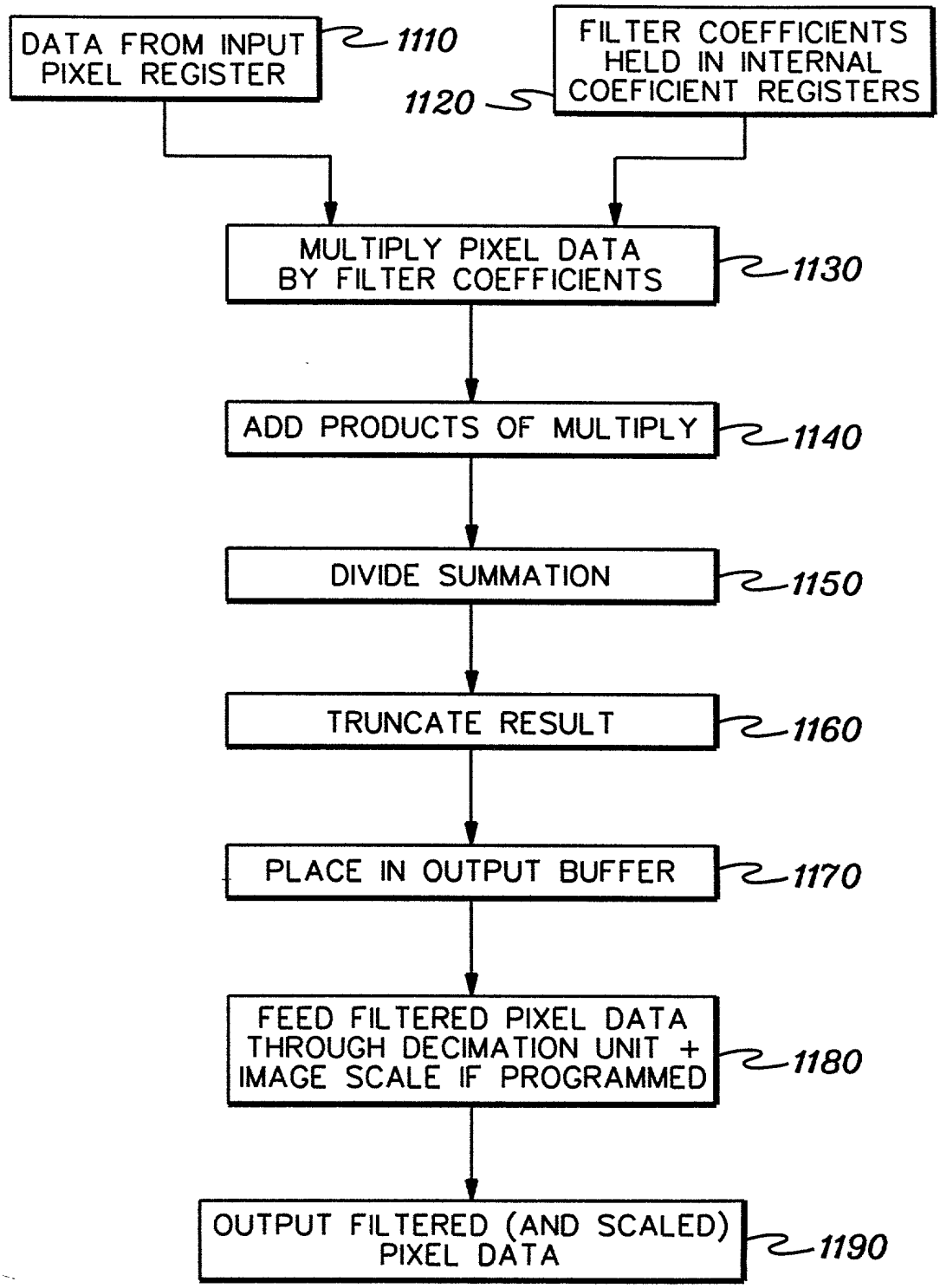

DATA FROM INPUT PIXEL REGISTER
1110
FILTER COEFFICIENTS HELD IN INTERNAL COEFICIENT REGISTERS
1120
MULTIPLY PIXEL DATA BY FILTER COEFFICIENTS
1130
ADD PRODUCTS OF MULTIPLY
1140
DIVIDE SUMMATION
1150
TRUNCATE RESULT
1160
PLACE IN OUTPUT BUFFER
1170
FEED FILTERED PIXEL DATA THROUGH DECIMATION UNIT + IMAGE SCALE IF PROGRAMMED
1180
OUTPUT FILTERED (AND SCALED) PIXEL DATA
1190

fig. 11

KEY: HORIZONTAL NOISE REDUCTION FILTER AND SCALER

(EXAMPLE: NOISE REDUCTION ONLY)
P= 'ORIGINAL' PIXELS
C= FILTER COEFFICIENTS ('PHASE 0' ONLY) C_1-C_8
F= FILTERED PIXEL OUTPUT

BEGINNING OF LINE (LUMINANCE DATA)

$$[(P_1 \cdot C_1)+(P_1 \cdot C_2)+(P_1 \cdot C_3)+(P_1 \cdot C_4)+(P_2 \cdot C_5)+(P_3 \cdot C_6)+(P_4 \cdot C_7)+(P_5 \cdot C_8)]/256 = F_1$$
$$[(P_1 \cdot C_1)+(P_1 \cdot C_2)+(P_1 \cdot C_3)+(P_2 \cdot C_4)+(P_3 \cdot C_5)+(P_4 \cdot C_6)+(P_5 \cdot C_7)+(P_6 \cdot C_8)]/256 = F_2$$
$$[(P_1 \cdot C_1)+(P_1 \cdot C_2)+(P_2 \cdot C_3)+(P_3 \cdot C_4)+(P_4 \cdot C_5)+(P_5 \cdot C_6)+(P_6 \cdot C_7)+(P_7 \cdot C_8)]/256 = F_3$$
$$[(P_1 \cdot C_1)+(P_2 \cdot C_2)+(P_3 \cdot C_3)+(P_4 \cdot C_4)+(P_5 \cdot C_5)+(P_6 \cdot C_6)+(P_7 \cdot C_7)+(P_8 \cdot C_8)]/256 = F_4$$
$$[(P_2 \cdot C_1)+(P_3 \cdot C_2)+(P_4 \cdot C_3)+(P_5 \cdot C_4)+(P_6 \cdot C_5)+(P_7 \cdot C_6)+(P_8 \cdot C_7)+(P_9 \cdot C_8)]/256 = F_5$$

$\vdots$

END OF LINE (HORIZ. SIZE = 720 PIXELS)

$$[(P_{713} \cdot C_1)+(P_{714} \cdot C_2)+(P_{715} \cdot C_3)+(P_{716} \cdot C_4)+(P_{717} \cdot C_5)+(P_{718} \cdot C_6)+(P_{719} \cdot C_7)+(P_{720} \cdot C_8)]/256=F_{716}$$
$$[(P_{714} \cdot C_1)+(P_{715} \cdot C_2)+(P_{716} \cdot C_3)+(P_{717} \cdot C_4)+(P_{718} \cdot C_5)+(P_{719} \cdot C_6)+(P_{720} \cdot C_7)+(P_{720} \cdot C_8)]/256=F_{717}$$
$$[(P_{715} \cdot C_1)+(P_{716} \cdot C_2)+(P_{717} \cdot C_3)+(P_{718} \cdot C_4)+(P_{719} \cdot C_5)+(P_{720} \cdot C_6)+(P_{720} \cdot C_7)+(P_{720} \cdot C_8)]/256=F_{718}$$
$$[(P_{716} \cdot C_1)+(P_{717} \cdot C_2)+(P_{718} \cdot C_3)+(P_{719} \cdot C_4)+(P_{720} \cdot C_5)+(P_{720} \cdot C_6)+(P_{720} \cdot C_7)+(P_{720} \cdot C_8)]/256=F_{719}$$
$$[(P_{717} \cdot C_1)+(P_{718} \cdot C_2)+(P_{719} \cdot C_3)+(P_{720} \cdot C_4)+(P_{720} \cdot C_5)+(P_{720} \cdot C_6)+(P_{720} \cdot C_7)+(P_{720} \cdot C_8)]/256=F_{720}$$

fig. 12

KEY: HORIZONTAL NOISE REDUCTION FILTER AND SCALER
(EXAMPLE: 2/3 HORIZONTAL IMAGE SCALING)
P= 'ORIGINAL' PIXELS
C= FILTER COEFFICIENTS – (C_1-C_8) (PHASE 0 AND PHASE 1)
F= FILTERED PIXEL OUTPUT

BEGINNING OF LINE (LUMINANCE DATA)

$[(P_1 \cdot C_1)+(P_1 \cdot C_2)+(P_1 \cdot C_3)+(P_1 \cdot C_4)+(P_2 \cdot C_5)+(P_3 \cdot C_6)+(P_4 \cdot C_7)+(P_5 \cdot C_8)]/256$

(C_1-C_8) PHASE 0 = F_1 (KEEP)

$[(P_1 \cdot C_1)+(P_1 \cdot C_2)+(P_1 \cdot C_3)+(P_2 \cdot C_4)+(P_3 \cdot C_5)+(P_4 \cdot C_6)+(P_5 \cdot C_7)+(P_6 \cdot C_8)]/256$

(C_1-C_8) PHASE 1 = F_2 (KEEP)

$[(P_1 \cdot C_1)+(P_1 \cdot C_2)+(P_2 \cdot C_3)+(P_3 \cdot C_4)+(P_4 \cdot C_5)+(P_5 \cdot C_6)+(P_6 \cdot C_7)+(P_7 \cdot C_8)]/256$

(C_1-C_8) PHASE 1 = F_3 (DROP)

$[(P_1 \cdot C_1)+(P_2 \cdot C_2)+(P_3 \cdot C_3)+(P_4 \cdot C_4)+(P_5 \cdot C_5)+(P_6 \cdot C_6)+(P_7 \cdot C_7)+(P_8 \cdot C_8)]/256$

(C_1-C_8) PHASE 0 = F_4 (KEEP)

$[(P_2 \cdot C_1)+(P_3 \cdot C_2)+(P_4 \cdot C_3)+(P_5 \cdot C_4)+(P_6 \cdot C_5)+(P_7 \cdot C_6)+(P_8 \cdot C_7)+(P_9 \cdot C_8)]/256$

(C_1-C_8) PHASE 1 = F_5 (KEEP)

$[(P_3 \cdot C_1)+(P_4 \cdot C_2)+(P_5 \cdot C_3)+(P_6 \cdot C_4)+(P_7 \cdot C_5)+(P_8 \cdot C_6)+(P_9 \cdot C_7)+(P_{10} \cdot C_8)]/256$

(C_1-C_8) PHASE 1 = F_6 (DROP)

⋮

fig. 13

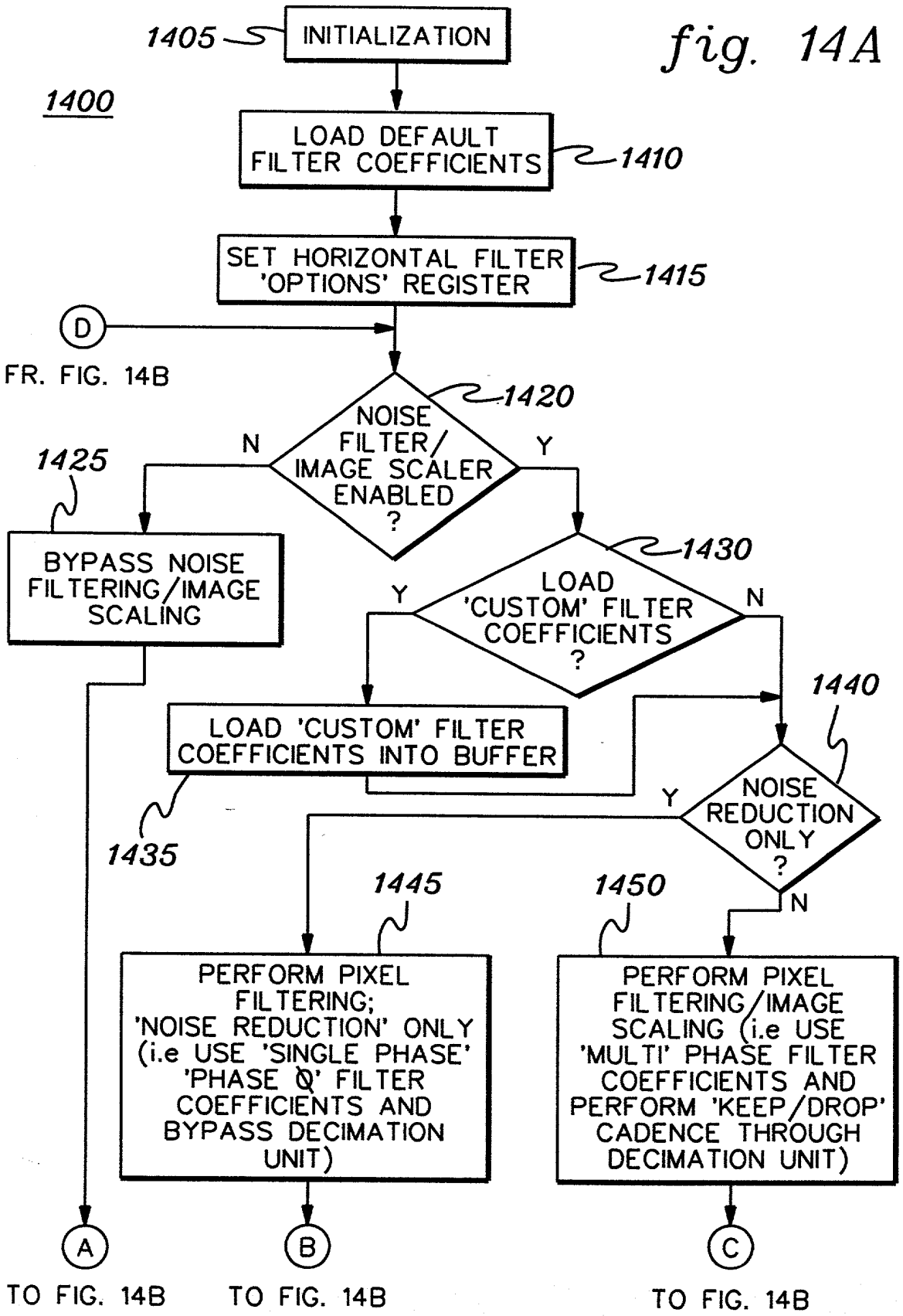

1405
INITIALIZATION
1400
LOAD DEFAULT FILTER COEFFICIENTS
1410
SET HORIZONTAL FILTER 'OPTIONS' REGISTER
1415
D
FR. FIG. 14B
1420
NOISE FILTER/ IMAGE SCALER ENABLED ?
N
Y
1425
BYPASS NOISE FILTERING/IMAGE SCALING
1430
LOAD 'CUSTOM' FILTER COEFFICIENTS ?
Y
N
LOAD 'CUSTOM' FILTER COEFFICIENTS INTO BUFFER
1435
1440
NOISE REDUCTION ONLY ?
Y
N
1445
1450
PERFORM PIXEL FILTERING; 'NOISE REDUCTION' ONLY (i.e USE 'SINGLE PHASE' 'PHASE 0' FILTER COEFFICIENTS AND BYPASS DECIMATION UNIT)
PERFORM PIXEL FILTERING/IMAGE SCALING (i.e USE 'MULTI' PHASE FILTER COEFFICIENTS AND PERFORM 'KEEP/DROP' CADENCE THROUGH DECIMATION UNIT)
A
B
C
TO FIG. 14B
TO FIG. 14B
TO FIG. 14B

fig. 14A

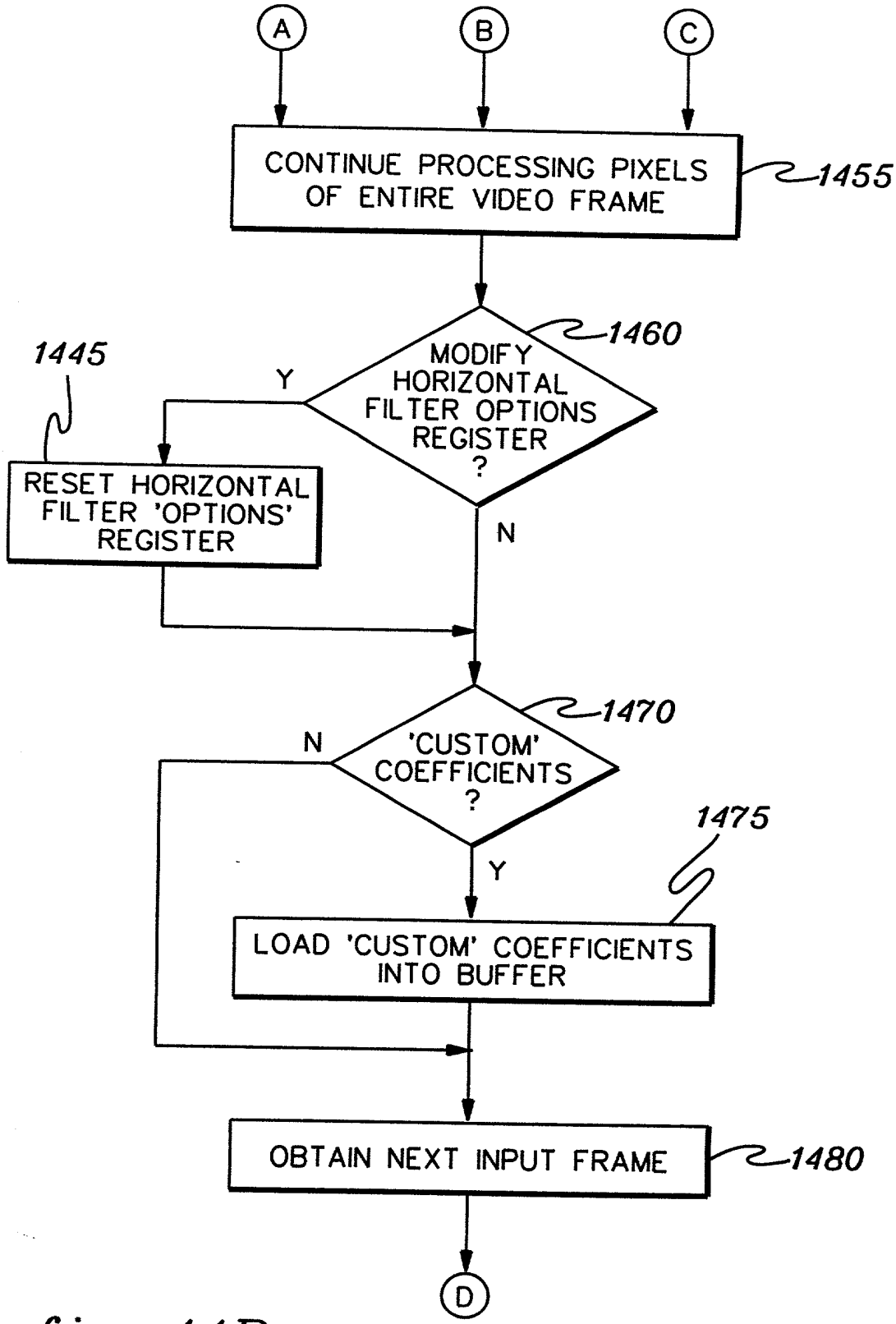


fig. 14B

TO FIG. 14A